

***Crepidotus subfulviceps* comb. nov., a stipitate *Crepidotus* from temperate North America and Europe**

M. CATHERINE AIME¹, JORDI VILA² & PIERRE-ARTHUR MOREAU³

¹*maime@agcenter.lsu.edu*

*Department of Plant Pathology and Crop Physiology, Louisiana State University
Agricultural Center, Baton Rouge, LA 70803 USA*

²*Rector Ubach, 53, ático 2ª, E-08021 Barcelona SPAIN*

³*Laboratoire de Botanique, Faculté des Sciences Pharmaceutiques et Biologiques
3 rue du Professeur Laguesse, B.P. 83, F-59006 Lille Cedex FRANCE*

Abstract — Nuclear rDNA sequence analyses indicate that *Tubaria decurrens*, a Pan-American species recently discovered in Spain, belongs in the genus *Crepidotus*. This is the fourth reported centrally stipitate species in the otherwise predominantly pleurotoid genus *Crepidotus*. The new combination *Crepidotus subfulviceps* is proposed.

Key words — Agaricales, Crepidotaceae, fungal systematics, *Melanomphalia*

Introduction

The *Crepidotaceae* (*Basidiomycota*, *Agaricales*) s. Singer (1986) contains several genera of centrally stipitate mushrooms that have since been excluded from the family based on nuclear rDNA sequence analyses and type studies (Aime et al. 2005). However, it was concluded that while the type species of *Tubaria* (W.G. Sm.) Gillet and *Melanomphalia* M.P. Christ. did not belong in *Crepidotaceae*, several other taxa currently allied within those genera might be more closely related to *Crepidotus* than to the types of the former two genera, warranting further study (Aime et al. 2005). The genus *Tubaria* has since been shown to be polyphyletic (Matheny et al. 2007) and at least one species of *Melanomphalia* has been transferred to *Crepidotus* based on rDNA analyses (Aime et al. 2002).

Recently Vila et al. (2007) found several collections of a centrally stipitate mushroom in Spain that was found to be conspecific with *Tubaria decurrens*, a Pan-American species originally described from Kansas. The taxon was completely described and illustrated and the authors speculated on the relationship between *T. decurrens* and members of the *Crepidotaceae*. Subsequent phylogenetic analyses of the nuclear large subunit rDNA region

confirms that this taxon is, in fact, a *Crepidotus* species and the new combination *C. subfulviceps* is proposed to accommodate it.

Materials and methods

A total of 19 species were chosen for analysis. Exemplar taxa, including type species from *Crepidotus* [type, *C. mollis* (Schaeff.) Staude 1857], *Tubaria* [type, *T. furfuracea* (Pers.) Gillet 1876], and *Melanomphalia* [type, *M. nigrescens* M.P. Christ. 1936], were selected from previously published *Crepidotaceae* nuclear large subunit rDNA (LSU) datasets (Moncalvo et al. 2000, 2002; Aime et al. 2002, 2005; Aime & Miller 2002) and from the genus *Inocybe*, which has been suggested as the sister group to the *Crepidotaceae* s.s. (Matheny et al. 2006). DNA was extracted from dried tissue from two herbarium specimens of *Tubaria decurrens*, placed in 2 mL Bead Solution tubes of the UltraClean Plant DNA Isolation Kit, and extracted per the manufacturer's instructions (MoBio Laboratories, Inc., Solana Beach, CA). The first 1250 bp of the LSU were amplified and sequenced with primers LSU4-B (Aime & Phillips-Mora 2005) and LR6 (Moncalvo et al. 1995) and sequenced as previously described in Aime & Phillips-Mora (2005). Specimen vouchers are deposited in Herbarium BCN (Centre de Documentació de Biodiversitat Vegetal, Universitat de Barcelona); sequence vouchers are deposited in GenBank (<http://www.ncbi.nlm.nih.gov/>).

For phylogenetic analyses, sequences were edited and contiguous sequences were assembled in Sequencher v.4.1.4 (Gene Codes Corp., Ann Arbor, MI). Sequence alignments were constructed by eye in Se-Al v2.0a11 (Andrew Rambaut, Dept. Zoology, University of Oxford, U.K.; <http://evolve.zoo.ox.ac.uk/>). Regions too variable to confidently align (a total of 27 bp in a single indel region) were excluded from the final analyses. Maximum parsimony (MP) analyses were conducted in PAUP* v4.0b10 (Swofford 2002) as heuristic searches with 100 random addition replicates and TBR branch swapping. Support for the branching topologies was evaluated by bootstrap analysis derived from 1000 replicates with 10 random addition replicates each.

Taxonomy

***Crepidotus subfulviceps* (Murrill) Aime, Vila & P.-A. Moreau, comb. nov.**

MYCOBANK MB513297

BASIONYM: *Omphalina subfulviceps* Murrill, Lloydia 7(4): 309 (1945, "1944").

= *Flammula decurrens* Peck, Bull. Torrey Bot. Club 22(12): 489 (1895).

= *Tubaria decurrens* (Peck) Murrill, North American Flora 10(2): 159 (1917).

?= *Tubaria omphaliopsis* Singer, in Singer & Digilio, Lilloa 25: 397 (1952, "1951").

= *Melanomphalia omphaliopsis* (Singer) Singer, in Petersen, Evolution in the higher Basidiomycetes: 459 (1971).

MATERIAL STUDIED: SPAIN. CATALONIA: Girona, Palafrugell, 30 Sep 2003, C. Roqué (BCN SCM B-5138), GenBank FJ947117; Prés de la Punta de la Creueta, Tarragona, 18 Oct 2005, J. Vila, X. Llimona, and L. Balcells (BCN SCM B-5144), GenBank FJ947116.

COMMENTS: *Crepidotus* is a genus with over 250 described species of saprotrophic pleurotoid agarics (Hesler & Smith 1965). Sequence analyses from the nuclear LSU rDNA region confirm the placement of *T. decurrens* within the

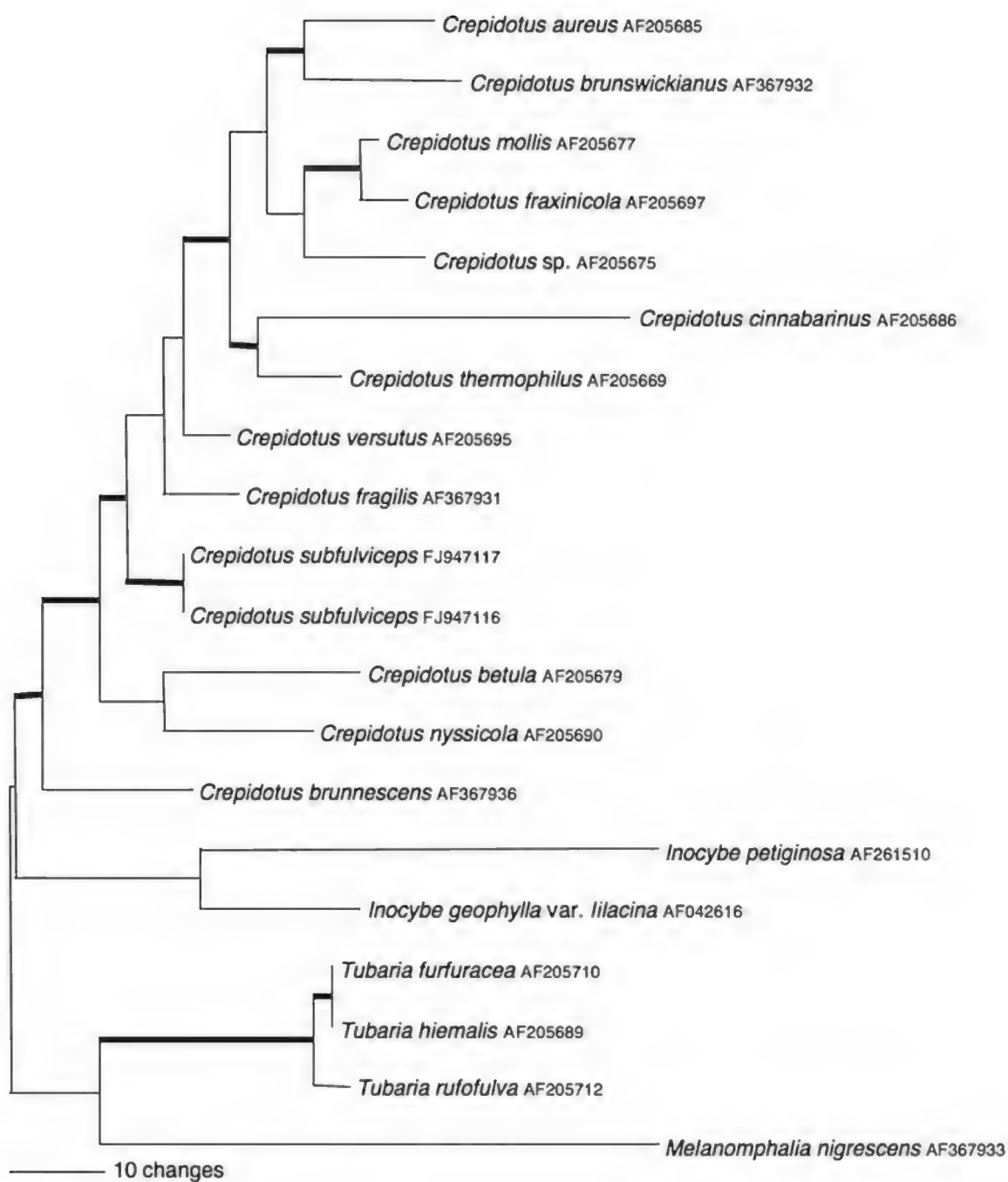


FIGURE 1. Mid-point rooted phylogenetic tree from MP analyses of nuclear large subunit ribosomal DNA showing position of *C. subfulviceps* within *Crepidotus*. Thickened branches are those receiving significant (>75% bootstrapping) support.

genus *Crepidotus* (FIG. 1). The internal transcribed spacer region of the nuclear rDNA was also sequenced and analyzed with the same result (data not shown). Thus, the placement of *T. decurrens* within *Crepidotus* marks the fourth stipitate species of *Crepidotus* within this otherwise pleurotoid genus (Hesler & Smith 1965, Aime et al. 2002).

Phylogenetic analyses show that three of the known species of stipitate *Crepidotus*—*C. nyssicola* (Murrill) Singer 1973, *C. thermophilus* (Singer) Aime et al. 2002, and *C. subfulviceps*—do not form a monophyletic group (FIG. 1)

and therefore represent independent reversions to the stipitate habit within this genus. *Crepidotus subfulviceps* can be easily distinguished from the other known stipitate species of *Crepidotus* by its basidiospores, which are small (avg. 5 µm diam), globose and strongly echinulate in *C. nyssicola* versus amygdaliform in *C. subfulviceps*, and shorter (7.0–10.7 µm) with verrucose ornamentation in *C. thermophilus* versus 9.5–10.8 µm and faintly rugose in *C. subfulviceps*. A fourth species, *Crepidotus ibericus* (G. Moreno & Esteve-Rav.) Bandala et al. 2008 has recently been transferred to *Crepidotus* (Bandala et al. 2008) and differs from the other known stipitate species in having smooth basidiospores.

The combination *Crepidotus decurrens* is not available for this taxon. *Crepidotus decurrens* States (States 1973) is a synonym for the North American *C. cinnabarinus* Peck 1895 (Luther & Redhead 1981), an astipitate temperate species distinguished by its scarlet-red pileus and gills that has no relation to *T. decurrens*. Thus, *C. subfulviceps* becomes the oldest available name that can be unambiguously assigned to this taxon. *Crepidotus subfulviceps* has been completely described and illustrated in Vila et al. 2007.

Acknowledgments

The authors wish to thank Jean Lodge and Tim Baroni, as well as the Editor-in-Chief and Nomenclature Editor of MYCOTAXON, for their expert review of this manuscript.

Literature cited

- Aime MC, Baroni TJ, Miller OK. 2002. *Crepidotus thermophilus* comb nov., a reassessment of *Melanomphalia thermophila*, a rarely collected tropical agaric. *Mycologia* 94: 1059–1065.
- Aime MC, Miller OK. 2002. Delayed germination of basidiospores in temperate species of *Crepidotus* (Fr.) Staude. *Canadian Journal of Botany* 80: 280–287.
- Aime MC, Phillips-Mora W. 2005. The causal agents of witches' broom and frosty pod rot of cacao (chocolate, *Theobroma cacao*) form a new lineage of *Marasmiaceae*. *Mycologia* 97(5): 1012–1022.
- Aime MC, Vilgalys R, Miller OK. 2005. The *Crepidotaceae* (*Basidiomycota*, *Agaricales*): Phylogeny and taxonomy of the genera and revision of the family based on molecular evidence. *American Journal of Botany* 92: 74–82.
- Bandala VM, Esteve-Raventós F, Montoya L. 2008. Two remarkable brown-spored agarics from Spain: *Simocybe parvispora* sp. nov. and *Crepidotus ibericus* comb. nov. *Sydowia* 60:181–196.
- Hesler LR, Smith AH. 1965. *North American Species of Crepidotus*. Hafner Publishing Company, New York, New York, USA.
- Luther BS, Redhead SA. 1981. *Crepidotus cinnabarinus* in North America. *Mycotaxon* 12: 417–430.
- Matheny PB, Curtis JM, Hofstetter V, Aime MC, Moncalvo JM, Ge ZW, Yang ZL, Slot JC, Ammirati JF, Baroni TJ, Bougher NL, Hughes KW, Lodge DJ, Kerrigan RW, Seidl MT, Aanen DK, DeNitis M, Daniele GM, Desjardin DE, Kropp BR, Norvell LL, Parker A, Vellinga EC, Vilgalys R, Hibbett DS. 2006. Major clades of *Agaricales*: a multilocus phylogenetic overview. *Mycologia* 98 (6): 982–995.

- Matheny PB, Vellinga EC, Bougher NL, Ceska O, Moreau PA, Neves MA, Ammirati JF. 2007. Taxonomy of displaced species of *Tubaria*. *Mycologia* 99: 569–585.
- Moncalvo JM, Lutzoni F, Rehner SA, Johnson J, Vilgalys R. 2000. Phylogenetic relationships of agaric fungi based on nuclear large subunit ribosomal DNA sequences. *Systematic Biology* 49: 278–305.
- Moncalvo JM, Vilgalys R, Redhead SA, Johnson JE, James TY, Aime MC, Hofstetter V, Verduin SJW, Larsson E, Baroni TJ, Thorn RG, Jacobsson S, Cléménçon H, Miller OK. 2002. One hundred and seventeen clades of euagarics. *Molecular Phylogenetics and Evolution* 23: 357–400.
- Moncalvo JM, Wang HH, Hseu RS. 1995. Phylogenetic relationships in *Ganoderma* inferred from the internal transcribed spacers and 25S ribosomal DNA sequences. *Mycologia* 87: 223–238.
- Peck CH. 1895. New species of fungi. *Bulletin of the Torrey Botanical Club* 22: 485–493.
- Singer R. 1986. The *Agaricales* in modern taxonomy, 4th ed. Koeltz Scientific Books, Koenigstein, Germany.
- States J. 1973 (“1972”). A new red-colored species of *Crepidotus*. *Bulletin of the Torrey Botanical Club* 99: 250–251.
- Swofford DL. 2002. PAUP*: Phylogenetic analysis using parsimony (*and other methods), version 4. Sinauer, Sunderland, MA.
- Vila J., Moreau P-A, Tabarés M, Carbó J, Pérez-de-Gregorio MA. 2007. *Tubaria decurrens*, une espèce américaine redécouverte en Europe (*Tubaria decurrens*, a American species found in Europe). *Cryptogamie Mycologie* 28: 1–11.